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Margins and liquidity in European energy markets in 2022

Key takeaways

- *European futures markets for natural gas and electricity were deeply disrupted by the events following the Russian invasion of Ukraine, including through large fluctuations in margins.*
- *The fluctuations in margins put significant liquidity demands on market participants, prompting the official sector to establish liquidity facilities in some jurisdictions.*
- *Fluctuations in initial margins were associated with material reductions in open interest of market participants, in line with standard deleveraging mechanisms seen in financial markets.*

Commodity prices soared in the wake of the Russian invasion of Ukraine in February 2022. The shock was particularly acute in the natural gas and electricity markets in Europe. Wholesale electricity prices, on average, increased fourfold in the months following the invasion, amid unprecedented levels of volatility, and price dispersion among trading hubs. The main European benchmark price for natural gas, Title Transfer Facility (TTF), surged to levels 10 times higher than in the preceding decade (Avalos and Huang (2022)). European derivatives markets for both electricity and natural gas were deeply disrupted by these developments. In futures markets, margins jumped to extraordinarily high levels. For several weeks, intraday margin calls worth hundreds of millions of dollars became customary, imposing severe liquidity and leverage constraints on market participants. Reportedly, some traders and commercial users significantly reduced their hedging of commodities prices (FSB (2023)). The funding strains prompted the establishment of official liquidity facilities in several countries.

In this Bulletin, we revisit the events of 2022 in European markets for natural gas and electricity, with a focus on the effect of margin adjustments on liquidity conditions and hedging activity. We find that during this period, in addition to the very large increases in variation margins, initial margins tended to increase more than prices, implying that investors needed to come up with higher down payments when using futures contracts. Furthermore, the extraordinary margin calls coincided with a sudden, if brief, tightening of funding markets in late February 2022. The forced deleveraging due to higher initial margins led to material and persistent reductions in open interest.

The first section briefly describes the structure and functioning of European derivatives markets for natural gas and electricity. In the second section we review the events of 2022, and their impact on margin calls, as well as the associated liquidity and leverage constraints. The third section studies how shocks to initial margins, as a share of prices, affected open interest.

Natural gas and electricity markets in Europe

Derivatives markets are a key element in the proper functioning of the energy sector. In the particular case of electricity, where the opportunities for efficient storage are limited, derivatives facilitate the smooth matching of supply and demand over time. For instance, operators of the distribution network in any city would tend to contract the daily provision of power several months in advance, to avoid the large operational (and possibly financial) risk of relying on next-hour, or day-ahead, markets. Electricity generators also value the ability to plan ahead their supply, contracting their sales well in advance of

delivery. In the natural gas market, derivatives also help to optimise the management of storage capacity. This indirectly helps to balance electricity markets when short-term supply-demand gaps arise. This is because natural gas can be activated and deactivated whenever demand fluctuates, in contrast with intermittent sources such as solar or wind generation.

European derivatives markets comprise several exchanges where futures and options are traded publicly between anonymous counterparties, alongside a large over-the-counter (OTC) market where forwards are arranged bilaterally. A key difference between exchange-traded derivatives (ETDs) and OTC forwards is the margining arrangement. ETDs are centrally cleared and subject to stricter margin requirements, which aim to reduce credit risk for the central counterparties (CCPs). In contrast, OTC forwards typically do not involve CCPs (ie they are cleared and settled bilaterally), and margin requirements are more flexible with regard to levels, timing of calls and eligible collateral. The business relationship between traders and banks allows this flexibility in forwards, in contrast to the "arm's length" approach that characterises futures. Following the Great Financial Crisis of 2008, regulators set up rules to encourage market participants to clear standardised OTC derivatives via CCPs. These rules had a material impact in interest rate swaps and credit default swaps, but less so in other asset classes such as commodities (Aramonte and Huang (2019)).

For ETDs, both variation margins (VMs) and initial margins (IMs) play significant roles in ensuring proper risk management. VM is paid in cash and settles marked-to-market profits and losses: when prices rise, VM is paid by those holding short positions to those with long positions, and vice versa. IM is posted when a position is opened and maintained. It is designed to safeguard the CCP against potential future fluctuations in contract value in the event of a counterparty default. It is typically sensitive to price and volatility, and must be posted by market participants upon initiating positions, regardless of their direction. Importantly, when market conditions change (eg higher volatility or higher spot prices), market participants may be asked to post additional IM to maintain their positions. CCPs request IM in the form of cash or high-quality liquid assets. When price moves are unusually large, there is a trade-off between increasing IM to reduce counterparty credit risk for the CCP and limiting funding risk for the market participants, ie the risk that one of them cannot meet margin calls (Cohen and Tracol (2023)). While CCPs are regulated to mitigate systemic risk, they keep flexibility in calculating IM, especially during times of stress. Finally, IM calls have a systemic liquidity impact by design, as the CCP collects liquid assets from both counterparties, while VM calls have mainly a distributional impact of liquidity between counterparties (Huang and Takáts (2020)).

Futures margins surged repeatedly in 2022

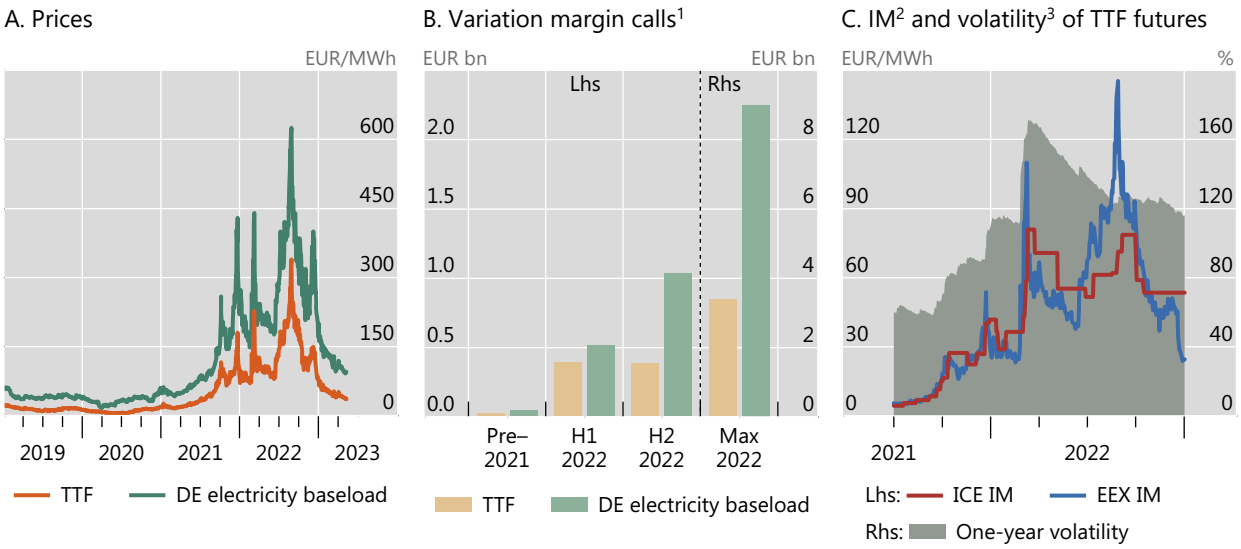
The outbreak of the war in Ukraine in February 2022 saw the prices of natural gas and electricity surge to unprecedented levels, amid extreme volatility. These increases came when European energy markets were already showing signs of increased stress from mid-2021.[1] TTF increased to €340 per megawatt-hour (MWh) in August 2022, while its level typically fluctuated between €3.5 and €23 per MWh in 2019 and 2020 (Graph 1.A). The electricity prices and volatility mirrored the turbulence in the natural gas market. The German wholesale electricity price rose from around €50 per MWh at end-2020 to more than €600 per MWh in August 2022.

The large price increases generated very large VM calls in ETDs. Using the margin data of the front-month futures – the most liquid contracts – we estimate that average daily VM calls for TTF increased more than 16-fold to about €392 million in the first half of 2022, from €24 million in the period before 2021, even reaching €3.4 billion on the most volatile day (Graph 1.B). Average daily VM calls for German wholesale electricity markets experienced even more extreme shocks, increasing from about €5 million in the period before 2021 to more than €1 billion after the start of the Ukraine war, with a daily maximum that reached as high as €9 billion. These extraordinary VM payments fell on traders with **short** positions

[1] See Avalos and Huang (2022) for a description of the conditions in European natural gas and electricity markets leading up to the beginning of the war.

in futures, which were often Gazprom customers or electricity generators, with **long** positions in the physical market. In the long run, weeks or quarters ahead, some of these traders may have benefited from these increases in the price of physical gas or electricity, as they would have sold them and realised the gains. But in the short run, VM needed to be paid immediately – typically within 24 hours. This maturity mismatch between traders' assets and liabilities led to significant liquidity strains.

As prices and volatility jumped, margins rose sharply — Graph 1



[1] Margin calls are estimated using front-month futures. [2] IM per MWh. [3] Based on a one-year moving window where more weight is given to the most recent events (ie exponentially weighted moving average).

Sources: Bloomberg; EEX; ICE (the data have been made available in accordance with the terms of use); BIS.

IM skyrocketed, although to different degrees, across the two major European exchanges: European Energy Exchange (EEX) and Intercontinental Exchange (ICE).[2] While the IM of both ICE and EEX contracts on TTF started at about €5 per MWh in early 2021, they reached peaks of €145 for EEX and €79 for ICE. Early in 2022, when the Russian invasion of Ukraine began, IM tracked the path of both prices and volatility closely (Graph 1C). In the second half of 2022, however, as the prices of both natural gas and electricity climbed *gradually* to record high levels, the one-year weighted volatility – which is often used in margining models – slowly decreased. Yet IM requirements continued rising together with prices, albeit in different ways: ICE modified its IM only occasionally, in steps that could be large, while EEX recalibrated it daily based on the latest price movements. On aggregate, daily IM calls for TTF increased from typically €0.6 million in the period before 2021 to more than €40 million right after the start of the war, with a daily maximum reaching €1.3 billion. Similarly, daily IM calls for German wholesale baseload electricity reached almost €6 billion at the peak, compared with an average of €50 million in the period before 2021.

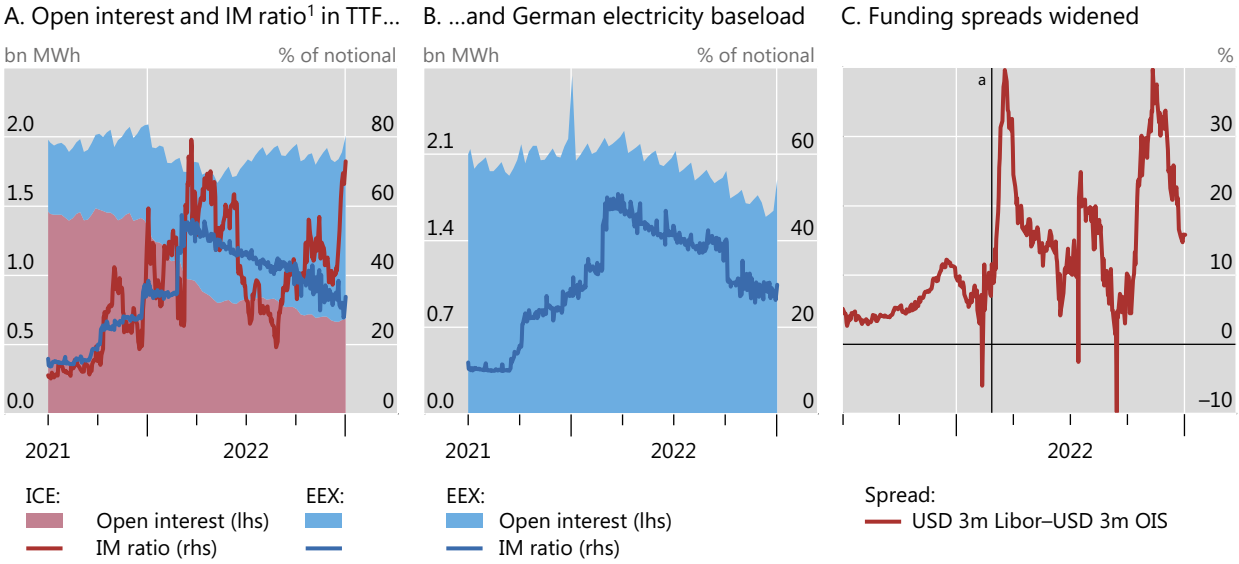
From an economic standpoint, IM hikes quickly curb the leverage capacity of market participants (Aramonte et al (2022), Brunnermeier and Pedersen (2007)). As discussed above, traders must post IM to the exchange using cash or high-quality collateral. Any increase in IM must be funded, from either own funds or borrowing short-term in money markets, which was particularly difficult in the environment of the first half of 2022 (see below). The IM ratio – the ratio of IM to price per contract – is reciprocal to the leverage of the positions. For natural gas and electricity contracts, the IM ratio rarely exceeded 20% before

[2] ICE focuses on products linked to TTF, while EEX also offers products linked to specific European electricity markets such as those of Germany, France and Italy, among others. The two CCPs that clear for these exchanges – ICE Clear Europe and European Commodity Clearing (ECC) – have different IM methodologies, leading to differences in their margin requirements.

September 2021, allowing for more than fivefold leverage.[3] In March 2022, when the IM ratio in natural gas markets climbed to around 60% and that of electricity markets to around 50%, in practice the leverage was reduced materially to less than twofold.

Increases in initial margin coincided with declines in open interest in early 2022 as funding conditions tightened

Graph 2



OIS = overnight index swap.

[a] Start of the war in Ukraine.

[1] The ratio of per contract required IM in euros to contract value.

Sources: Bloomberg; EEX; ICE (the data have been made available in accordance with the terms of use); BIS.

In 2022, IM ratios became extremely high and volatile, restricting leverage. For instance, while the IM ratio of TTF contracts in EEX gradually declined from the peak of 60% in March 2022 to 30% in late 2022, this IM ratio rose further to over 80% in ICE and continued fluctuating widely between 20 and 60% in the rest of the year (Graph 2.A). The stepwise shifts in ICE margin meant that not only were the collateral requirements from its IM calls less frequent, but ICE also kept the collateral for longer after prices and/or volatility had fallen. In this context, natural gas futures trading shifted materially from ICE to EEX. Open interest in EEX TTF futures doubled from around 0.7 billion MWh at end-2021 to 1.3 billion MWh at end-2022, while open interest in ICE declined from 1.3 billion MWh to around 0.7 billion MWh over the same period. The IM ratio for German electricity, which is mainly traded in EEX, approached a peak of 50% and then dropped gradually to 30%, which is still substantially higher than the early 2021 level of 10% (Graph 2.B).

The surge in margin calls coincided with widening spreads in funding markets. The Libor–overnight index swap (OIS) spread, still a major barometer of global unsecured funding costs at the time, jumped from 7 basis points on the eve of the war in Ukraine to about 40 basis points shortly afterwards (Graph 2.C). The steep energy price increases of February–March 2022 suggest that some traders facing stiff funding constraints could have potentially set in motion margin spirals. That is, forced by the sizeable IM and VM calls, some traders with short positions needed to close them, which would require them to buy back the contracts, probably intensifying price increases and triggering another round of margin calls. For instance, electricity generators locked in short positions were experiencing a double whammy of margin calls in the futures markets (both IM and VM), compounded by the need to rely on the wholesale electricity or natural

[3] In simple terms, traders could pay less than $20 today to purchase commodities worth $100 to be delivered at the end of the contract (leverage = asset value / equity = 100 / 20 = 5). In this way, they are implicitly borrowing more than $80 until the contract expiry.

gas markets, at much higher prices, to deliver on their short-term commitments, as their pipeline gas supply was interrupted.

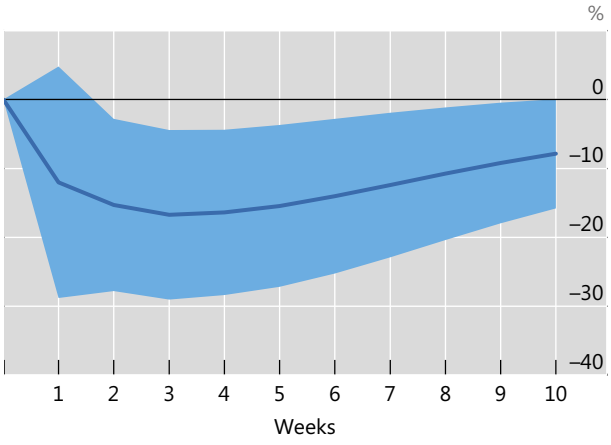
As dislocations spilled over throughout energy markets, public authorities of several countries stepped in to offer support for energy firms and the associated banks (Reuters (2022)). The German government extended financial help to energy firm Uniper to the tune of €19 billion. The Bank of England and the UK Treasury introduced a loan guarantee scheme to facilitate commercial banks in extending credit to energy firms (Bank of England (2022)). The substantial scale of the scheme, amounting to £40 billion (€47 billion), underscored the potential systemic implications of the stress. Market volatility subsided subsequently, perhaps due in part to the introduction of the scheme, and no firm took part. The Danish, Swedish and Finnish governments also offered guarantees of DKK 100 billion (€13 billion), SEK 250 billion (€23 billion) and €10 billion, respectively (Danish Ministry of Industry, Business and Financial Affairs (2022), Swedish National Debt Office (2022) and Ministry of Finance Finland (2022)). Other governments offered credit lines to specific energy firms, eg €3.8 billion for the Swiss electricity generator and distributor Axpo.

Impact of initial margins on open interest

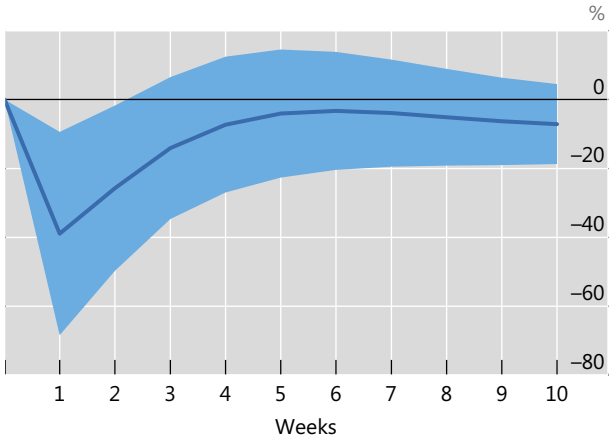
We gauge the quantitative impact of shifts in IM ratios on open interest (OI) with a vector autoregression (VAR) model. As higher IM ratios implicitly reduce the leverage of positions, and typically increase funding costs and risks, they are likely to reduce traders' positions, which would be reflected in lower OI.

Open interest dropped when initial margins rose[1] Graph 3

A. Adverse shocks to initial margins led to a cut in open interest of TTF futures…



B. …as well as in the open interest in futures of German baseload electricity



Impulse response function 95% confidence interval

[1] The vector autoregression (VAR) model includes the following variables: price, 30-day rolling volatility (backward-looking), IM ratio and open interest of all future contracts. The impulse response functions show the response of open interest (in MWh) to a one standard deviation increase in the IM ratio. Based on weekly data from January 2021 through December 2022.

Sources: Bloomberg; EEX; ICE (the data have been made available in accordance with the terms of use); BIS.

Our empirical analysis suggests that increases in IM ratios have led to material, and sometimes persistent, decreases in total OI across both exchanges. For TTF, total OI decreases by about 17% within three weeks after an increase of the IM ratio by 13 percentage points (Graph 3.A). The negative effect lasts for a prolonged period and begins to vanish only about 10 weeks after the shock. In the German electricity market, an increase in the same ratio of 13 percentage points leads to a drop of about 39% within a week (Graph 3.B), but the response is transient, and tends to vanish within two to four weeks. In practice, OI in TTF dropped from more than 2 billion MWh at the beginning of 2022 to about 1.6 billion across both ICE

and EEX (Graph 2.A). For German electricity, OI dropped from about 2.2 billion MWh to about 1.5 billion (Graph 2.B).

Conclusion

Margins mitigate the impact of market participants' defaults on CCPs which, overall, enhances financial stability. On the other hand, the tumultuous circumstances of the European energy markets in 2022 illustrate how fluctuations in margins can affect liquidity conditions for market participants, with possible spillovers to related financial markets, such as money markets. Low IM ratios in tranquil times enable market participants to build up leverage, but high IM ratios in stress times force them to deleverage and, in some cases, reduce their positions. If deleveraging deteriorates market conditions, it might trigger additional IM increases and even further deleveraging, leading to margin spirals.

Liquidity stress stemming from sudden increases in margining in extreme market conditions has sometimes elicited official sector interventions, as seen in 2022. As private entities, CCPs may not fully internalise the systemic risk implications of their margining practices. The procyclicality of some elements of the margining frameworks, such as VM, cannot be eliminated by CCPs, as it directly mirrors market prices. However, anti-procyclical measures on IM could mitigate spillovers. Additionally, transparency with regard to IM models may equip market participants to anticipate better their liquidity needs proactively (BCBS-CPMI-IOSCO (2023)).

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